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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Rosangela Pirri

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ARKEMA INC.

PATENT DEPARTMENT - 26TH FLOOR

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PHILADELPHIA, PA 19103-3222

EXAMINER

FINK, BRIEANN R

ART UNIT

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1796

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/588,422	Applicant(s) PIRRI ET AL.	
	Examiner Brieann R. Fink	Art Unit 1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 June 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 and 16-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 16-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This office action follows a reply filed on June 5, 2009. Claims 1 and 14 have been amended. Claims 1-14 and 16-20 are currently pending and under examination.
2. The texts of those sections of Title 35 U.S. Code are not included in this section and can be found in a prior Office action.

Claim Rejections - 35 USC § 103

3. Claims 1-10, 13-14 and 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Giacobbe* (US 5,453,544), in view of *Nierlich et al.* (US 5,994,601).

Giacobbe teaches that thiols can be prepared by the addition of hydrogen sulfide to olefins in the presence of a catalyst, such as an acid catalyst (col. 1, ll. 10-18). This process has been used to prepare tertiary thiols through Markovnikov addition of hydrogen sulfide to a "tertiary" olefin, such as a butylene trimer (Id.).

Giacobbe does not teach the distillation properties of the dodecanthiol mixtures prepared from the butylene trimer.

Nierlich et al. teaches that dibutene is an isomeric mixture formed by the dimerization of n-butene, isobutene or both n-butene and isobutene to give di-n-butene, diisobutene, or dibutene, respectfully (col. 1, ll. 15-22). The dimers are distinguishable by their degree of branching (col.1, ll. 22-24), which is known in the art to effect the boiling point. *Nierlich et al.* teaches that the diisobutene has more highly branched molecules in the mixture of isomers, where di-n-butene

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has the least amount of branched molecules in the mixture of isomers (col. 24-26). Therefore, one would expect that tri-n-butene would also be less branched than triisobutene. Further, one would also expect that a mixture of tertiary thiols prepared from tri-n-butene would result in thiols with less branching than those prepared with triisobutene, evidenced by *Nierlich et al.* through the teaching of the use of di-n-butene to create nonanols versus diisobutene (col. 1, ll. 32-34).

It is further known in the art that Van der Waals forces are the forces that determine the boiling point of a molecular composition. The strength of these forces depends on the shape and size of the molecule. Molecules with less branching have more contact with each other, resulting in greater Van der Waals forces. Therefore, a molecule with less branching will require more energy to overcome of the forces to reach boiling/vaporization, hence a molecule with less branching will have a higher boiling point.

One of ordinary skill in the art at the time the invention was made would have expected a mixture of tert-dodecylthiols to have a higher boiling point (or higher distillation temperatures) when prepared with tri-n-butene as the butylene trimer, versus triisobutylene, in the invention of *Giacobbe*, as evidenced by *Nierlich et al.*, which would be more appropriate for use as a chain-transfer agent in a polymerization requiring higher temperatures.

Claims 14 and 15 can also be rejected as *prima facie* obvious over *Giacobbe* in view of *Nierlich et al.*, as above.

As to claims 3 and 17, *Giacobbe* teaches that sulfonic acid exchange resins can be used to convert olefins to thiols (col. 1, ll. 23-25).

As to claims 4 and 18, *Giacobbe* teaches the use of "AMBERLYST 15" as a sulfonic acid resin catalyst (col. 3, ll. 46-47), which is a copolymer of sulfonated styrene with divinylbenzene as evidenced by the instant specification (p. 5, ll. 21-23).

As to claims 5, 6, 13, and 19, *Giacobbe* teaches a molar ratio of hydrogen sulfide to olefin as 1.5:1 (col. 6, claim 3), whereas the instant invention requires a molar ratio of up to 100 (instant claim 5).

The molar ratio of hydrogen sulfide to olefin is an optimizable parameter. In any reaction, the concentrations of reactants can be manipulated to optimize the process of a routine experimental practice. One would be motivated to modify the concentrations of the reactants because *Giacobbe* suggests a molar ratio of hydrogen sulfide to olefin of 1.5, but also mentions that the hydrogen sulfide is present in excess (col. 2, ll. 38) in the production of tert-dodecylthiols.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the molar ratio of hydrogen sulfide to olefin to prepare tert-dodecylthiols with a reasonable expectation of success.

Modifying such a process is *prima facie* obvious because one of ordinary skill in the art would be motivated to optimize the experimental conditions, such as changing the molar ratio of hydrogen sulfide to olefin, to prepare a more

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efficient product or to explore economical and/or environmental advantages over the prior art, since it is within the scope to optimize experimental conditions through routine experimentation. Merely modifying the process conditions such as temperature and concentration is not a patentable modification absent a showing of criticality. *In re Aller*, 220 F.2d 454, 105 USPQ 233 (CCPA 1955).

MPEP 2144.05 (II)

As to claims 7-9 and 20, *Giacobbe* teaches the process of using zeolites as the catalyst for the preparation of tertiary mercaptans (col. 2, ll. 60-64). The preferred reaction temperature is between 70 to 160°C, preferably 90°C (col. 2, ll. 65-67). The pressure is noted as being autogenous (col. 2, ll. 65); however, another procedural embodiment, wherein the reaction pressure decreased from 900 psi (62 bar) to 260 psi (18 bar) as the olefin was added, where the pressure was then maintained at 260 psi for the remainder of the reaction.

As to claim 10, *Giacobbe* teaches that thiols can be prepared by the addition of hydrogen sulfide to olefins in the presence of an acid catalyst (col. 1, ll. 10-18).

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4. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Giacobbe* (US 5,453,544), in view of *Nierlich et al.* (US 5,994,601), As applied to claim 1, and further in view of *Hall et al.* (US 5,545,677).

Giacobbe in view of *Nierlich et al.* is *prima facie* obvious over claim 1, as noted above; however, neither teach the use of dodecanethiols as a chain transfer agent.

Hall et al. teaches that tert-dodecyl mercaptans are typical chain transfer agents in free radical polymerizations (col. 6, ll. 18-19 and 29-30).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the dodecanethiols of *Giacobbe* in view of *Nierlich et al.* as a chain transfer agent in a free radical polymerization as suggested by *Hall et al.* because they would be able to withstand higher temperatures of copolymerization if so desired.

5. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Giacobbe* (US 5,453,544), in view of *Nierlich et al.* (US 5,994,601), As applied to claim 1, and further in view of *Arretz* (US 6,228,006).

Giacobbe in view of *Nierlich et al.* is *prima facie* obvious over claim 1, as noted above; however, neither teach the use of dodecanethiols in the synthesis of di(tert-dodecyl) polysulfides.

Arretz teaches that polysulphides can be obtained by the reaction of a mercaptan with sulphur in the presence of a basic catalyst (col. 6, ll. 49-51).

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Further, *Arretz* teaches that the tertiary mercaptan incorporated into the reaction can be present in mixtures, and must have boiling points high enough to withstand the high temperatures required by the reaction; therefore, they must have a boiling point of higher than 150°C, preferably higher than 180°C (col. 6, ll. 32-40). A preferred tertiary mercaptan is tert-dodecyl mercaptan (col. 6, ll. 41-43).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the dodecanethiols of *Giacobbe* in view of *Nierlich et al.* in a reaction for the synthesis of di(tert-dodecyl) polysulfides as suggested by *Arretz* because the use of tri-n-butene versus triisobutene results in dodecanethiols with higher distillation temperatures, and therefore higher boiling points, as explained above, allowing for the thiols to withstand the high reaction temperatures needed for the synthesis of polysulphides.

6. The rejections, as set forth in the previous office action, are deemed proper and are therefore maintained.

Response to Arguments

7. Applicants' arguments, see p.6-9, filed June 5, 2009 have been fully considered but they are not persuasive.

a. The applicants argue that the above combination of references do not teach or suggest a dodecanethiol mixture that when used as a chain transfer agent will result in the formation of polymers having significantly lower viscosities.

This argument is only applicable to instant claim 11, as claims 1-10 and 1-20 are directed to a process for preparing a mixture of dodecanethiol, not the method of use of the mixture nor the product produced from its method of use.

As to claim 11, the examiner provides a *prima facie* case of obviousness such that it would have been obvious to one of ordinary skill in the art to have substituted a trimer of n-butene for a trimer of isobutene in the *Giacobbe* reference, as *Giacobbe* teaches that (a) butylene trimers are known to be used in the art to produce thiols (col. 1, ll. 15-17), suggests (b) using any olefin having a carbon number in the range from about 3 to about 15, and exemplifies (c) isobutylene (col. 2, ll. 60-62). In view of *Nierlich*, it would have been obvious to expect the mixture to have a higher boiling point, as described in the above rejection. Further, as taught by *Hall et al.*, it is known to one of ordinary skill in the art that dodecanethiols are used as chain transfer agents, and that it would have been obvious to use such a chain transfer agent taught by the combination of *Giacobbe* in view of *Nierlich* because the mixture would be able to withstand

higher temperatures of copolymerization due to its higher boiling point, if one so desired.

Further, the applicants point to the examples of the instant specification to show that using the dodecanethiol mixture prepared from a trimer of n-butene as a chain transfer agent in radical polymerization produces a polymer having an unexpected viscosity; however, the examples only provide a comparison between a styrene-butadiene polymer produced by a chain transfer agent prepared from tri(n-butene) versus that prepared from tetrapropylene (Example 1 versus Example 3). A proper comparison, on the other hand, would show a polymer produced from a chain transfer agent prepared with a trimer of n-butene versus that prepared with a trimer of isobutene.

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Briann R. Fink whose telephone number is (571)270-7344. The examiner can normally be reached on Monday through Friday, 7:00 AM to 4:30 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy P. Gulakowski can be reached on (571)272-1302. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/B. R. F./
Examiner, Art Unit 1796

/Randy Gulakowski/
Supervisory Patent Examiner, Art Unit 1796

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